

# PATENT ABSTRACTS OF JAPAN

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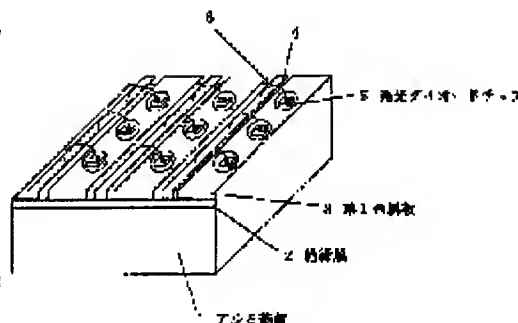
(72)Inventor : **MINE HIDENORI**

## (54) LIGHT EMITTING DIODE LIGHTING EQUIPMENT

(57)Abstract:

PROBLEM TO BE SOLVED: To achieve a high heat radiation property, and at the same time to reduce costs.

SOLUTION: Onto an aluminum substrate 1 with specific thickness, a first wide metal plate 3 and a second narrow metal plate 4 are put at specific intervals via an insulating film 2. A light emitting diode chip 5 is mounted while one electrode is connected to the first metal plate 3, and a lead 6 that is pulled out of another electrode of the light emitting diode chip 5 is connected to the second metal plate 4.



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CLAIMS

[Claim(s)]

[Claim 1] The light emitting diode lighting implement characterized by mounting light emitting diode (5) and one electrode becoming so that a metal plate (3) may be stuck through an insulator layer (2) on the metal substrate (1) excellent in heat dissipation nature and may be electrically connected to this metal plate (3).

[Translation done.]

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## DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the lighting implement which makes light emitting diode the light source.

[0002]

[Description of the Prior Art] The application as a signalling lamp or an annunciator has expanded light emitting diode from the low power and long lasting \*\* as what is replaced with an incandescent lamp. Recently the application as a traffic light etc. and the plotting board is especially expanded, and there is a demand of a raise in brightness and low-cost-izing for such an application.

[0003] In order to satisfy this demand, in addition to improvement in the luminous efficiency of the light emitting diode chip itself, use with a heavy load is needed. And when using it with a heavy load, it is important to make stripping of the heat to generate enough in respect of reservation of dependability, such as a life.

[0004] In consideration of this point, the thing which comes to give electric wiring on the substrate (for it to be hereafter called an aluminum substrate for short) which consists of aluminum excellent in heat dissipation nature as a substrate for lighting implements for raising the heat dissipation nature of a light emitting diode lighting implement through an insulating layer is proposed (refer to the patent No. 2593703 official report).

[0005]

[Problem(s) to be Solved by the Invention] However, in the substrate for lighting implements of the above-mentioned configuration, since the thermal resistance of the insulating layer used in order to insulate electric wiring from an aluminum substrate is large, there is un-arranging [ that the heat dissipation nature of an aluminum substrate cannot fully be pulled out ].

[0006] Moreover, since it is necessary to produce an electric wiring pattern by technique, such as plating, on an insulating layer in manufacturing the substrate for lighting implements, there is also un-arranging [ that the substrate for lighting implements will become expensive ].

[0007] While this invention is made in view of the above-mentioned trouble and being able to attain high heat dissipation nature, it aims at offering the light emitting diode lighting implement which can attain a cost cut.

[0008]

[Means for Solving the Problem] The light emitting diode lighting implement of claim 1 sticks a metal plate through an insulator layer on the metal substrate excellent in heat dissipation nature, light emitting diode is mounted and one electrode becomes so that may be electrically connected to this metal plate.

[0009]

[Function] If it is the light emitting diode lighting implement of claim 1, the metal substrate which was excellent in heat dissipation nature through the insulator layer can be made to conduct the heat which absorbed generation of heat of light emitting diode, and the metal plate absorbed with the heat capacity of a metal plate. And since the opposed face product (heat sinking plane product) of the metal plate

which counters through an insulator layer, and the metal substrate excellent in heat dissipation nature can be enlarged while being able to make the heat capacity of a metal plate larger than the heat capacity of the electric wiring pattern produced by technique, such as the conventional plating, remarkable high heat dissipation nature can be attained as compared with the conventional light emitting diode lighting implement.

[0010] Moreover, as compared with the case where an electric wiring pattern is produced by technique, such as plating, it can mass-produce and a cost cut can be attained.

[0011]

[Embodiment of the Invention] Hereafter, with reference to an accompanying drawing, the mode of operation of the light emitting diode lighting implement of this invention is explained to a detail.

[0012] Drawing 1 is the perspective view showing roughly the important section of the light emitting diode lighting implement of this invention.

[0013] On the given thickness Mino aluminum substrate 1, through the insulator layer 2, this light emitting diode lighting implement stuck the 1st broad metal plate 3 and the 2nd broad narrow-width metal plate 4, where predetermined spacing is separated mutually, where one electrode is connected to the 1st metal plate 3, it mounted the light emitting diode chip 5, and it has connected to the 2nd metal plate 4 the lead 6 pulled out from the electrode of another side of the light emitting diode chip 5.

[0014] Said 1st metal plate 3 has high electrical conductivity, greatly [ heat capacity ], consists of a metallic material with a good heat dissipation property, and can illustrate the alloy spent on copper, aluminum, and a leadframe as this metallic material. Moreover, what is necessary is just to set the thickness of the 1st metal plate 3 as hundreds of micrometers or more.

[0015] Of course, the 1st metal plate 3 and the 2nd metal plate 4 function as electric wiring.

[0016] Drawing 2 is drawing explaining an example of the production process of the light emitting diode lighting implement of this invention.

[0017] As shown in drawing 2 (a), the adhesive insulator layer 2 is formed on the aluminum substrate 1, and as shown in drawing 2 (b), the metal plate of the predetermined thickness it is thin from the alloy spent on copper, aluminum, and a leadframe is stuck on an insulator layer 2.

[0018] Subsequently, spinning is performed to a light emitting diode chip mounting schedule part in order to raise the directivity to the front, as shown in drawing 2 (c), and as shown in drawing 2 (d), by etching, machining, etc., a metal plate is processed into the 1st metal plate 3 and the 2nd metal plate 4, and let each be an electrical circuit.

[0019] Then, as shown in drawing 2 (e), an electrical circuit pattern is completed by mounting the light emitting diode chip 5 on the spinning section, connecting one electrode to the 1st metal plate 3 electrically, performing wirebonding subsequently and connecting electrically the electrode of another side of the light emitting diode chip 5 to the 2nd metal plate 4.

[0020] Finally, as shown in drawing 2 (f), an optical lens 7 is formed so that the mounted light emitting diode chip 5 may be covered.

[0021] However, it is possible to omit spinning and to omit formation of an optical lens.

[0022] Since the opposed face product of the aluminum substrate 1 and the 1st metal plate 3 which counter through an insulator layer 2 is large while the heat capacity of the circuit pattern by plating of the former [ heat capacity / of the 1st metal plate 3 ] etc. is large, when the light emitting diode lighting implement of the above-mentioned configuration is adopted, even if the heat conductivity of an insulator layer 2 is low, generation of heat of the light emitting diode chip 5 can be effectively conducted to the aluminum substrate 1, and the remarkably excellent heat dissipation property can be realized.

Consequently, use by the high current and high generation of heat can be enabled.

[0023] Moreover, it is possible by enlarging thickness of the 1st metal plate 3 to be able to raise the absorption capacity of heat, as a result to change a thermal design according to a service condition.

[0024] Furthermore, since the 1st metal plate 3 and the 2nd metal plate 4 are formed from a metal plate by etching, machining, etc., on an insulator layer, it can mass-produce as compared with the case where a circuit pattern is formed by plating etc., and the cost reduction effectiveness is. Moreover, also when the 1st metal plate 3 and the 2nd metal plate 4 are stuck on an insulator layer 2 after forming the 1st

metal plate 3 and the 2nd metal plate 4 from a metal plate by etching, machining, etc., it can mass-produce similarly and there is the cost reduction effectiveness.

[0025] Drawing 3 is drawing explaining other examples of the production process of the light emitting diode lighting implement of this invention.

[0026] The metal plate with which the part equivalent to the 1st metal plate 3 and the 2nd metal plate 4 was formed through the adhesive insulator layer 2 on the aluminum substrate 1 as the part equivalent to the 1st metal plate 3 and the 2nd metal plate 4 was formed and it was shown in {refer to drawing 3 (b)} and drawing 3 (c) is stuck by performing etching, machining, etc. to the metal plate shown in drawing 3 (a).

[0027] Subsequently, as shown in drawing 3 (d), while excising a garbage on the basis of a cutline, spinning is performed in order to raise the directivity to the front to the light emitting diode chip mounting schedule part of the 1st metal plate 3.

[0028] Then, as shown in drawing 3 (e), an electrical circuit pattern is completed by mounting the light emitting diode chip 5 on the spinning section, connecting one electrode to the 1st metal plate 3 electrically, performing wirebonding subsequently and connecting electrically the electrode of another side of the light emitting diode chip 5 to the 2nd metal plate 4.

[0029] Finally, as shown in drawing 3 (f), an optical lens 7 is formed so that the mounted light emitting diode chip 5 may be covered.

[0030] However, it is possible to omit spinning and to omit formation of an optical lens.

[0031] The light emitting diode lighting implement manufactured by this production process can realize the heat dissipation property which was remarkably excellent like the light emitting diode lighting implement manufactured by the production process of drawing 2, as a result can enable use by the high current and high generation of heat. Moreover, it can mass-produce like the production process of drawing 2, and there is the cost reduction effectiveness.

[0032] Drawing 4 is drawing showing the PN junction temperature (degree-C)-current loading time (minute) property of a light emitting diode. In addition, the inside A of drawing 4 corresponds to the conventional light emitting diode lighting implement, and the inside B of drawing 4 supports the light emitting diode lighting implement of drawing 1. Moreover, the current is set as 30mA.

[0033] The direction in [ B ] drawing 4 is saturated with lower temperature, and it can be said that heat dissipation nature is good so that drawing 4 may show.

[0034]

[Effect of the Invention] Invention of claim 1 can produce to arbitration electric wiring with larger heat capacity than the electric-wiring pattern produced by plating etc., can enlarge the area of the opposite section with the metal substrate which was moreover excellent in heat-dissipation nature, and since it sticks the effectiveness that heat leakage nature can be improved, and a metal plate, with the metal substrate which was excellent in heat-dissipation nature through the insulator layer and can produce them, it does so the effectiveness that it can mass-produce cheaply.

[Translation done.]

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**TECHNICAL FIELD**

[Field of the Invention] This invention relates to the lighting implement which makes light emitting diode the light source.

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PRIOR ART

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**EFFECT OF THE INVENTION**

[Effect of the Invention] Invention of claim 1 can produce to arbitration electric wiring with larger heat capacity than the electric-wiring pattern produced by plating etc., can enlarge the area of the opposite section with the metal substrate which was moreover excellent in heat-dissipation nature, and since it sticks the effectiveness that heat leakage nature can be improved, and a metal plate, with the metal substrate which was excellent in heat-dissipation nature through the insulator layer and can produce them, it does so the effectiveness that it can mass-produce cheaply.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the perspective view showing roughly the important section of the light emitting diode lighting implement of this invention.

[Drawing 2] It is drawing explaining an example of the production process of the light emitting diode lighting implement of this invention.

[Drawing 3] It is drawing explaining other examples of the production process of the light emitting diode lighting implement of this invention.

[Drawing 4] It is drawing showing the PN junction temperature (degree-C)-current loading time (minute) property of a light emitting diode.

[Description of Notations]

1 Aluminum Substrate 2 Insulator Layer

3 1st Metal Plate 5 Light Emitting Diode Chip

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[Translation done.]

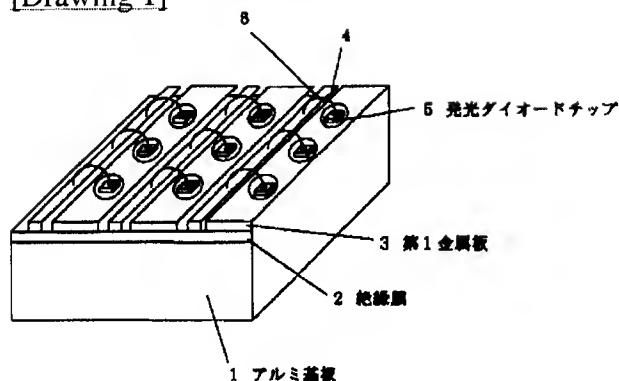
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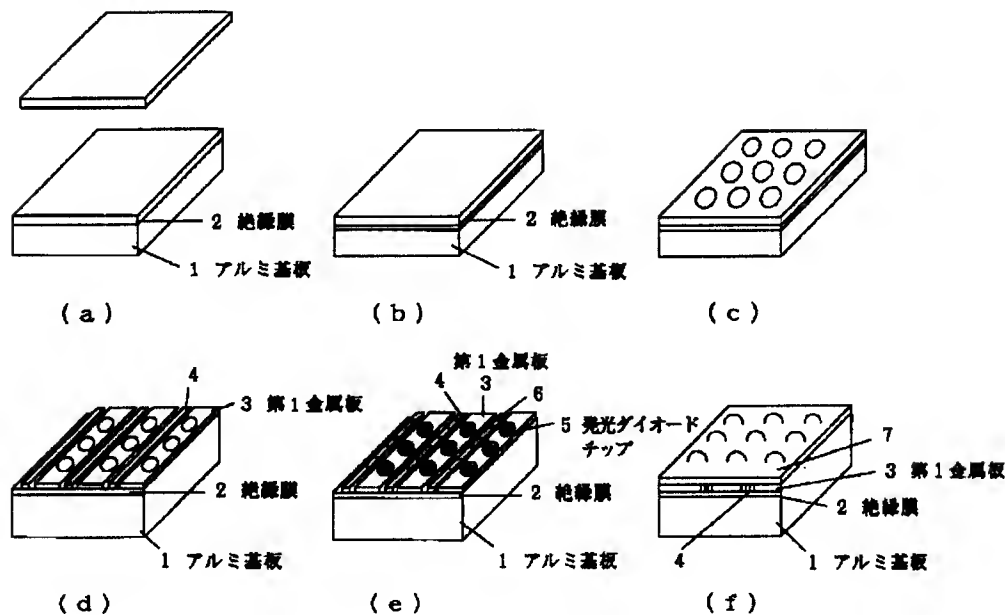
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## DRAWINGS

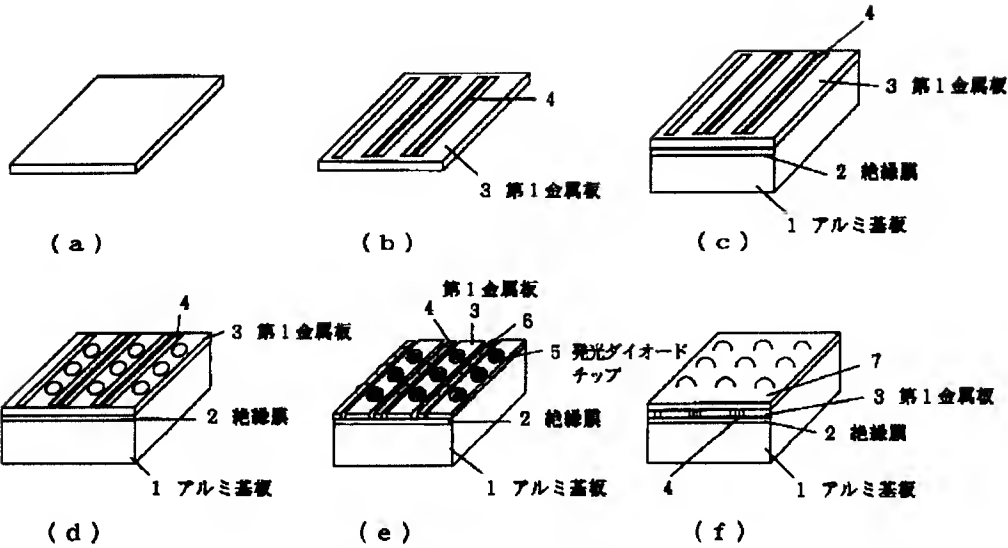
[Drawing 1]



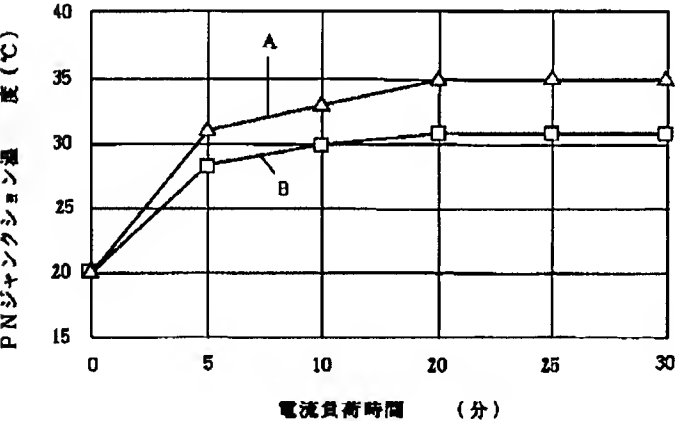
[Drawing 2]



[Drawing 3]



[Drawing 4]



[Translation done.]

## LIGHT EMITTING DIODE LIGHTING EQUIPMENT

**Publication number:** JP2001332768

**Publication date:** 2001-11-30

**Inventor:** MINE HIDENORI

**Applicant:** MITSUBISHI CABLE IND LTD

**Classification:**

- **International:** *F21V19/00; F21S8/04; F21S8/10; F21V5/04; H01L33/00; F21Y101/02; F21V19/00; F21S8/04; F21S8/10; F21V5/00; H01L33/00; (IPC1-7): H01L33/00; F21S8/04; F21S8/10; F21V5/04; F21V19/00; F21Y101/02*

- **European:**

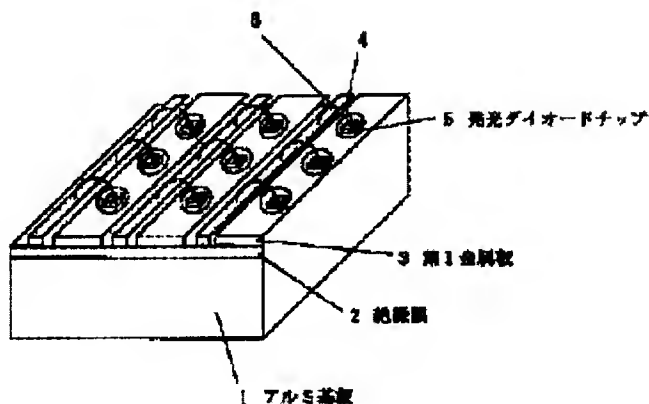
**Application number:** JP20000149861 20000522

**Priority number(s):** JP20000149861 20000522

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### Abstract of JP2001332768

**PROBLEM TO BE SOLVED:** To achieve a high heat radiation property, and at the same time to reduce costs. **SOLUTION:** Onto an aluminum substrate 1 with specific thickness, a first wide metal plate 3 and a second narrow metal plate 4 are put at specific intervals via an insulating film 2. A light emitting diode chip 5 is mounted while one electrode is connected to the first metal plate 3, and a lead 6 that is pulled out of another electrode of the light emitting diode chip 5 is connected to the second metal plate 4.



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F 2 1 S 8/10		F 2 1 V 5/04	Z 3 K 0 8 0
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3K080 AA15 BA07

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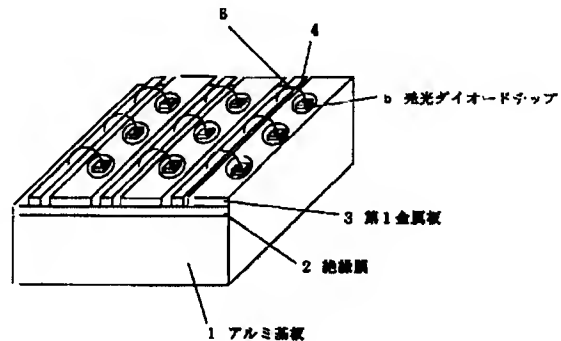
DA35 FF11

(54) 【発明の名称】 発光ダイオード照明具

(57) 【要約】

【課題】 高い放熱性を達成するとともに、コストダウンを達成する。

【解決手段】 所定厚みのアルミ基板1の上に絶縁膜2を介して幅広の第1金属板3および狭幅の第2金属板4を互いに所定間隔を隔てた状態で貼り付け、一方の電極を第1金属板3に接続した状態で発光ダイオードチップ5をマウントし、発光ダイオードチップ5の他方の電極から引き出されたリード6を第2金属板4に接続している。



【特許請求の範囲】

【請求項1】 放熱性に優れた金属基板(1)上に絶縁膜(2)を介して金属板(3)を貼り付け、この金属板(3)に一方の電極が電氣的に接続されるように発光ダイオード(5)をマウントしてなることを特徴とする発光ダイオード照明具。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】この発明は、発光ダイオードを光源とする照明具に関する。

【0002】

【従来の技術】発光ダイオードは、その低消費電力、長寿命等から、白熱電球に代わるものとして、信号灯や表示灯としての用途が拡大している。特に最近では、交通信号等や表示板としての用途が拡大しており、このような用途では高輝度化、低コスト化の要求がある。

【0003】この要求を満足するためには、発光ダイオードチップ自体の発光効率の向上に加え、高負荷での使用が必要とされる。そして、高負荷で使用する場合には、発生する熱の放散を十分にすることが、寿命等の信頼性の確保の点で重要である。

【0004】この点を考慮して、発光ダイオード照明具の放熱性を向上させるための照明具用基板として、放熱性に優れたアルミニウムからなる基板(以下、アルミ基板と略称する)の上に絶縁層を介して電気配線を施してなるものが提案されている(特許第2593703号公報参照)。

【0005】

【発明が解決しようとする課題】しかし、上記の構成の照明具用基板では、電気配線をアルミ基板から絶縁するために用いられている絶縁層の熱抵抗が大きいため、アルミ基板の放熱性を十分に引き出すことができないという不都合がある。

【0006】また、照明具用基板の製造を行うに当たっては、絶縁層の上に電気配線パターンをメッキ等の手法により作製する必要があるため、照明具用基板が高価なものになってしまうという不都合もある。

【0007】この発明は上記の問題点を鑑みてなされたものであり、高い放熱性を達成することができるとともに、コストダウンを達成することができる発光ダイオード照明具を提供することを目的としている。

【0008】

【課題を解決するための手段】請求項1の発光ダイオード照明具は、放熱性に優れた金属基板上に絶縁膜を介して金属板を貼り付け、この金属板に一方の電極が電氣的に接続されるように発光ダイオードをマウントしてなるものである。

【0009】

【作用】請求項1の発光ダイオード照明具であれば、金属板の熱容量によって発光ダイオードの発熱を吸収し、

金属板が吸収した熱を絶縁膜を通して放熱性に優れた金属基板に伝導させることができる。そして、金属板の熱容量を従来のメッキ等の手法により作製された電気配線パターンの熱容量よりも大きくすることができるとともに、絶縁膜を介して対向する金属板と放熱性に優れた金属基板との対向面積(放熱面積)を大きくすることができるので、従来の発光ダイオード照明具と比較して著しく高い放熱性を達成することができる。

【0010】また、メッキ等の手法により電気配線パターンを作製する場合と比較して、大量生産が可能であり、コストダウンを達成することができる。

【0011】

【発明の実施の形態】以下、添付図面を参照して、この発明の発光ダイオード照明具の実施の態様を詳細に説明する。

【0012】図1はこの発明の発光ダイオード照明具の要部を概略的に示す斜視図である。

【0013】この発光ダイオード照明具は、所定厚みのアルミ基板1の上に絶縁膜2を介して幅広の第1金属板3および狭幅の第2金属板4を互いに所定間隔を隔てた状態で貼り付け、一方の電極を第1金属板3に接続した状態で発光ダイオードチップ5をマウントし、発光ダイオードチップ5の他方の電極から引き出されたリード6を第2金属板4に接続している。

【0014】前記第1金属板3は、電気伝導度が高く、熱容量が大きく、かつ放熱特性が良好な金属材料からなるものであり、この金属材料としては、銅、アルミニウム、リードフレームに使われる合金などが例示できる。また、第1金属板3の厚みは数百 $\mu$ m以上に設定すればよい。

【0015】もちろん、第1金属板3および第2金属板4は電気配線として機能するものである。

【0016】図2はこの発明の発光ダイオード照明具の製造工程の一例を説明する図である。

【0017】図2(a)に示すようにアルミ基板1の上に接着性の絶縁膜2を設け、図2(b)に示すように、絶縁膜2の上に銅、アルミニウム、リードフレームに使われる合金などからなる所定厚みの金属板を貼り付ける。

【0018】次いで、図2(c)に示すように、前方への指向性を高めるべく発光ダイオードチップマウント予定箇所に絞り加工を施し、図2(d)に示すようにエッチング、機械加工等によって金属板を第1金属板3および第2金属板4に加工してそれぞれを電気回路とする。

【0019】その後、図2(e)に示すように、絞り加工部に発光ダイオードチップ5をマウントして一方の電極を第1金属板3に電氣的に接続し、次いでワイヤボンディングを行って発光ダイオードチップ5の他方の電極を第2金属板4に電氣的に接続することにより電気回路パターンを完成させる。



【0020】最後に、図2(f)に示すように、マウントされた発光ダイオードチップ5を覆うように光学レンズ7を設ける。

【0021】ただし、絞り加工を省略し、また光学レンズの形成を省略することが可能である。

【0022】上記の構成の発光ダイオード照明具を採用した場合には、第1金属板3の熱容量が従来のメッキなどによる配線パターン熱容量が大きいとともに、絶縁膜2を介して対向するアルミ基板1と第1金属板3との対向面積が大きいのであるから、絶縁膜2の熱伝導率が低くても、発光ダイオードチップ5の発熱を効果的にアルミ基板1に伝導し、著しく優れた放熱特性を実現することができる。この結果、大電流、高発熱での使用が可能とすることができる。

【0023】また、第1金属板3の厚みを大きくすることによって熱の吸収容量を高めることができ、ひいては使用条件に合わせて熱設計を変更することが可能である。

【0024】さらに、エッチング、機械加工等によって金属板から第1金属板3および第2金属板4を形成するのであるから、絶縁膜の上にメッキなどにより配線パターンを形成する場合と比較して大量生産が可能であり、コスト削減効果がある。また、エッチング、機械加工等によって金属板から第1金属板3および第2金属板4を形成した後に第1金属板3および第2金属板4を絶縁膜2上に貼り付けるようにした場合にも、同様に大量生産が可能であり、コスト削減効果がある。

【0025】図3はこの発明の発光ダイオード照明具の製造工程の他の例を説明する図である。

【0026】図3(a)に示す金属板に対してエッチング、機械加工等を施すことによって、第1金属板3および第2金属板4に相当する部分を形成し(図3(b)参照)、図3(c)に示すようにアルミ基板1の上に接着性の絶縁膜2を介して、第1金属板3および第2金属板4に相当する部分が形成された金属板を貼り付ける。

【0027】次いで、図3(d)に示すように、カットラインを基準として不要部分を切除するとともに、第1金属板3の発光ダイオードチップマウント予定箇所に、前方への指向性を高めるべく絞り加工を施す。

【0028】その後、図3(e)に示すように、絞り加工部に発光ダイオードチップ5をマウントして一方の電極を第1金属板3に電気的に接続し、次いでワイヤボン

ディングを行って発光ダイオードチップ5の他方の電極を第2金属板4に電気的に接続することにより電気回路パターンを完成させる。

【0029】最後に、図3(f)に示すように、マウントされた発光ダイオードチップ5を覆うように光学レンズ7を設ける。

【0030】ただし、絞り加工を省略し、また光学レンズの形成を省略することが可能である。

【0031】この製造工程によって製造された発光ダイオード照明具は図2の製造工程により製造された発光ダイオード照明具と同様に著しく優れた放熱特性を実現することができ、ひいては、大電流、高発熱での使用が可能とすることができる。また、図2の製造工程と同様に大量生産が可能であり、コスト削減効果がある。

【0032】図4は発光ダイオードのPNジャンクション温度(℃)ー電流負荷時間(分)特性を示す図である。なお、図4中Aが従来の発光ダイオード照明具に対応し、図4中Bが図1の発光ダイオード照明具に対応している。また、電流を30mAに設定している。

【0033】図4から分かるように、図4中Bの方がより低い温度で飽和しており、放熱性がよいといえる。

【0034】

【発明の効果】請求項1の発明は、メッキなどにより作製された電気配線パターンより熱容量が大きい電気配線を任意に作製することができ、しかも放熱性に優れた金属基板との対向部の面積を大きくすることができ、熱放散性を向上できるという効果、金属板を絶縁膜を介して放熱性に優れた金属基板と貼り合わせて作製できるので安価に量産することができるという効果を奏する。

【図面の簡単な説明】

【図1】この発明の発光ダイオード照明具の要部を概略的に示す斜視図である。

【図2】この発明の発光ダイオード照明具の製造工程の一例を説明する図である。

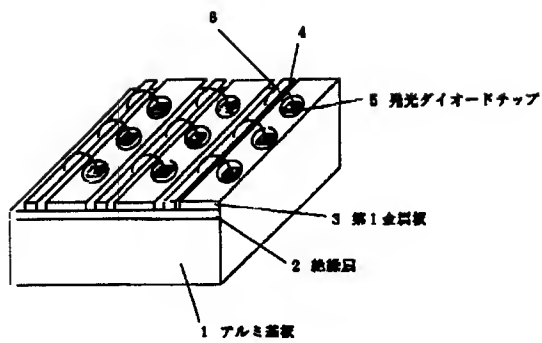
【図3】この発明の発光ダイオード照明具の製造工程の他の例を説明する図である。

【図4】発光ダイオードのPNジャンクション温度(℃)ー電流負荷時間(分)特性を示す図である。

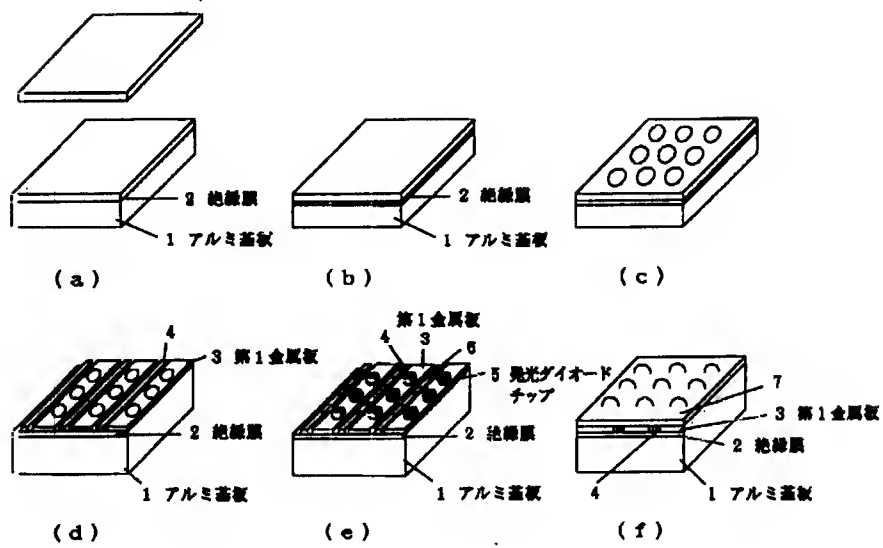
【符号の説明】

- |   |       |   |            |
|---|-------|---|------------|
| 1 | アルミ基板 | 2 | 絶縁膜        |
| 3 | 第1金属板 | 5 | 発光ダイオードチップ |

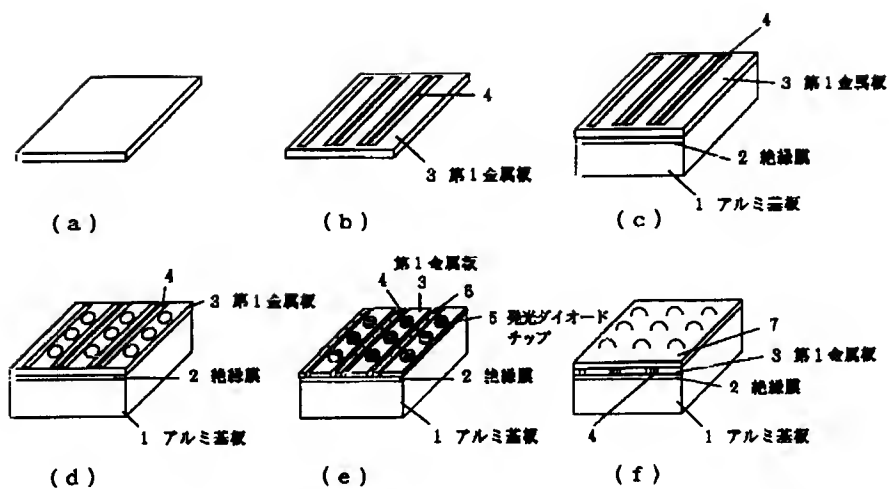
【図1】



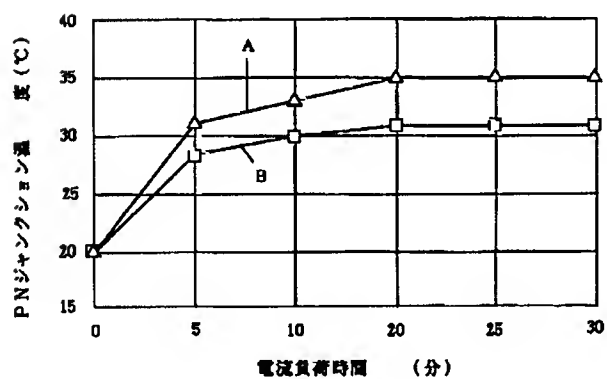
【図2】



【図3】



【図4】



フロントページの続き

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